

A stylized world map in white and light blue, centered on the Atlantic Ocean, serving as a background for the title text.

Pathways to Hydrogen

The Transportation Boom in Asia: New Transportation Technologies for China and India

Natural Gas Vehicle Technology Forum August 2, 2005
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INFORM



Background

INFORM

A national environmental research organization:

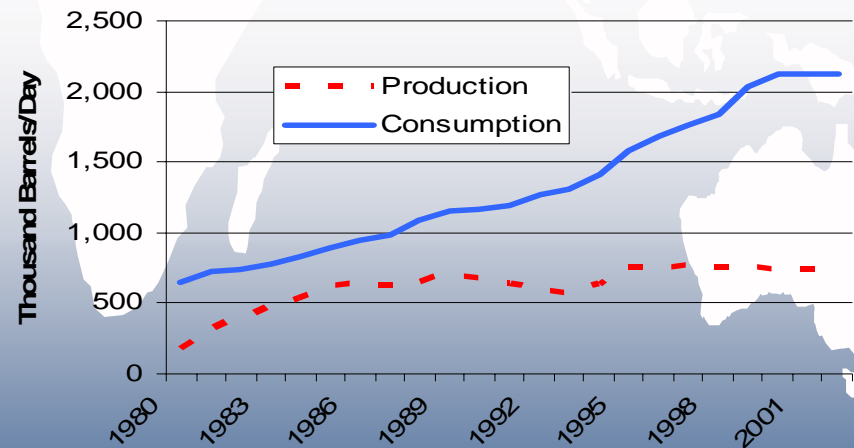
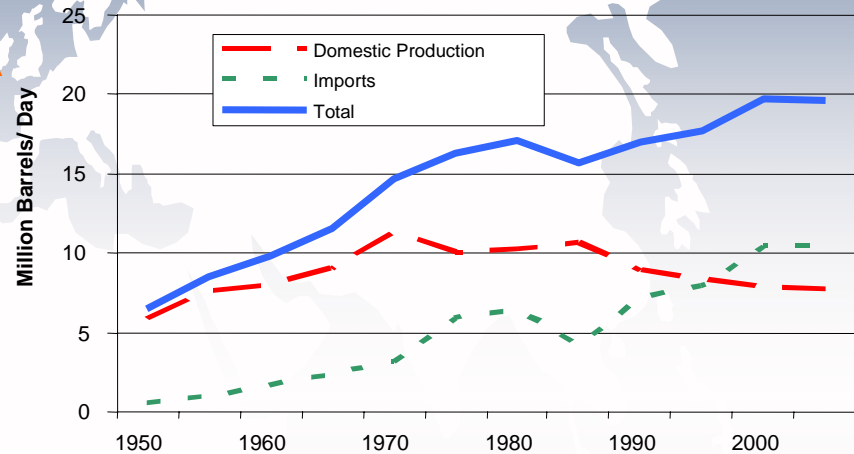
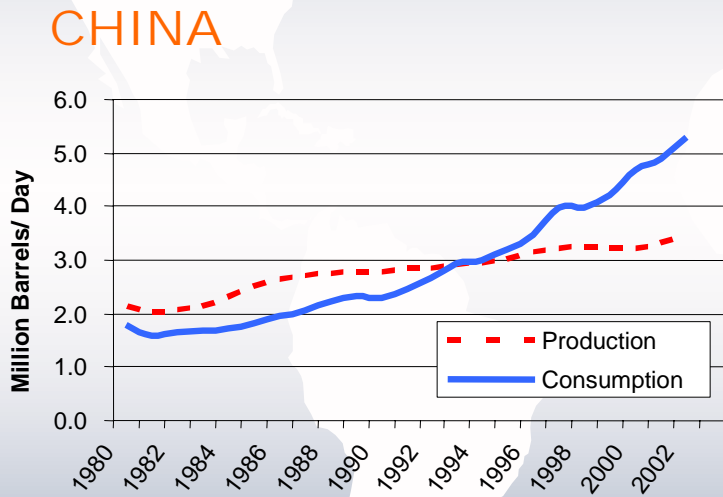
- ✓ Founded in 1974 to identify ways of doing business that are environmentally and economically sustainable
- ✓ Offers options for change that are thoroughly investigated, innovative, and effective
- ✓ Over a dozen transportation publications including:
 - *Drive for Clean Air (1990)*
 - *Harnessing Hydrogen (1995)*
 - *China at the Crossroads (1998)*
 - *Bus Futures (2000)*
 - *Greening Garbage Trucks (2003)*



Transportation Boom in Asia: INFORM's Four Research Goals

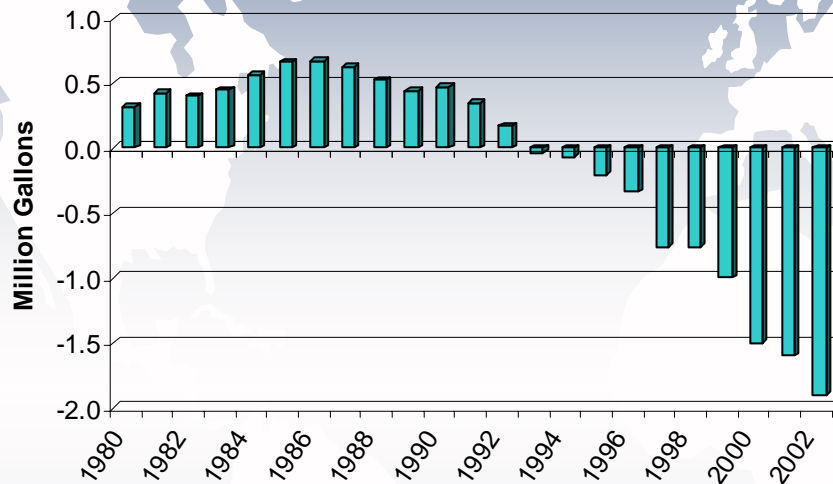
1. **What are the trends in oil consumption and transportation growth in China and India?**
2. **What are the implications for the US?**
3. **What are sustainable transportation goals for China, India and what steps are they taking?**
4. **What do US goals and progress look like and what more must we do?**

The Oil Crunch: Nations on a Collision Course



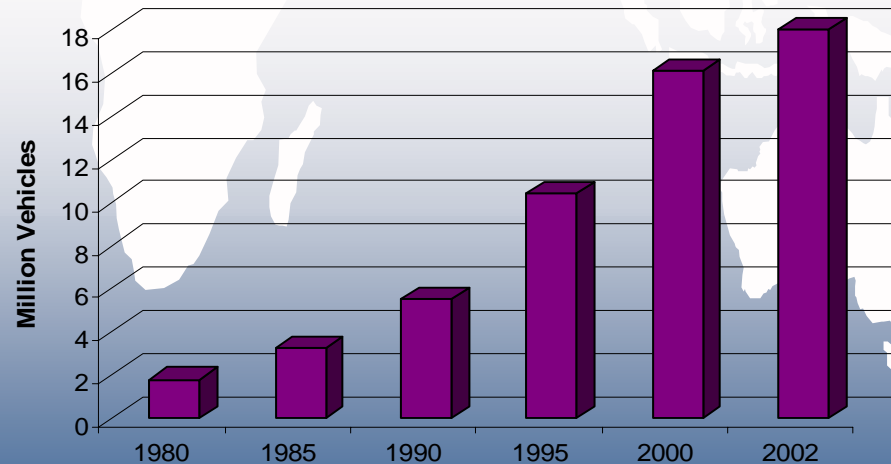
Source: EIA

China Oil and Vehicles



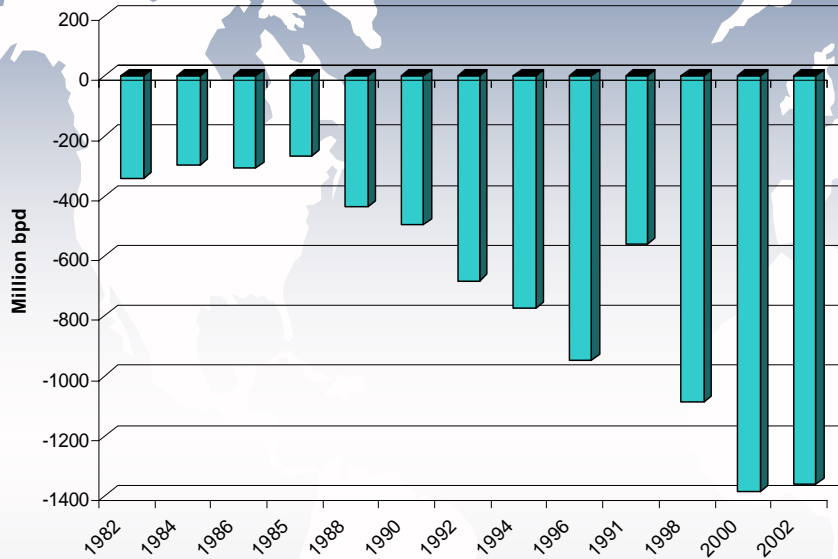
Oil Balance
from Surplus to
Imports

Motor Vehicle
Growth Since
1960



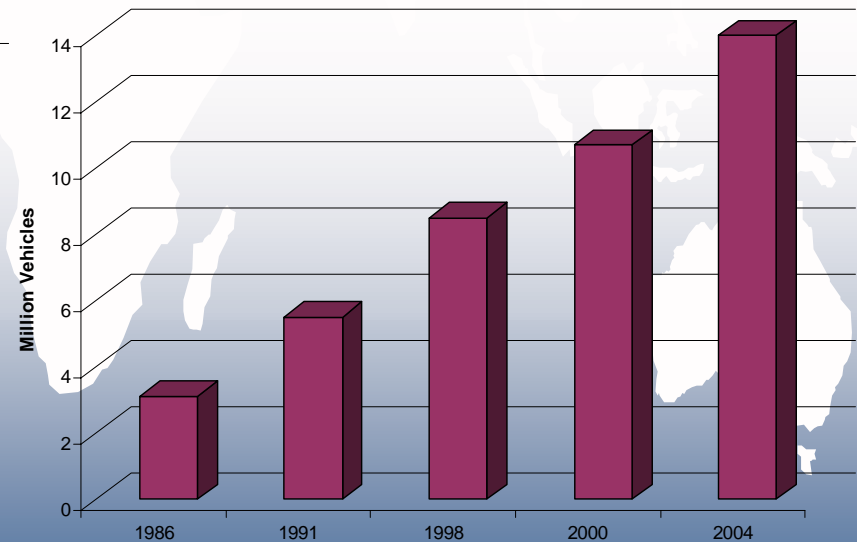
Source: EIA and China Sustainable Energy Project

India Oil and Vehicles



Growth in Negative Oil Balance toward Imports

Motor Vehicle Growth Since 1986



Source: EIA and SIAM

The Race for Oil Imports

A two way race for a vanishing resource

- ✓ In the 5 years through 2002, world oil production grew by 4.3 million bbl/d (3%)
- ✓ In last 5 years, oil consumption in the U.S. and China grew by 4.0 million bbl/day (17%)
- ✓ U.S. and China now top two oil importers
- ✓ Oil availability in rest of the world is constrained, competition is intense
- ✓ India imports increased a modest 200,000 bbl/day

Vehicle Ownership in China, India and Other Countries Relative to US Trend in the 20th Century

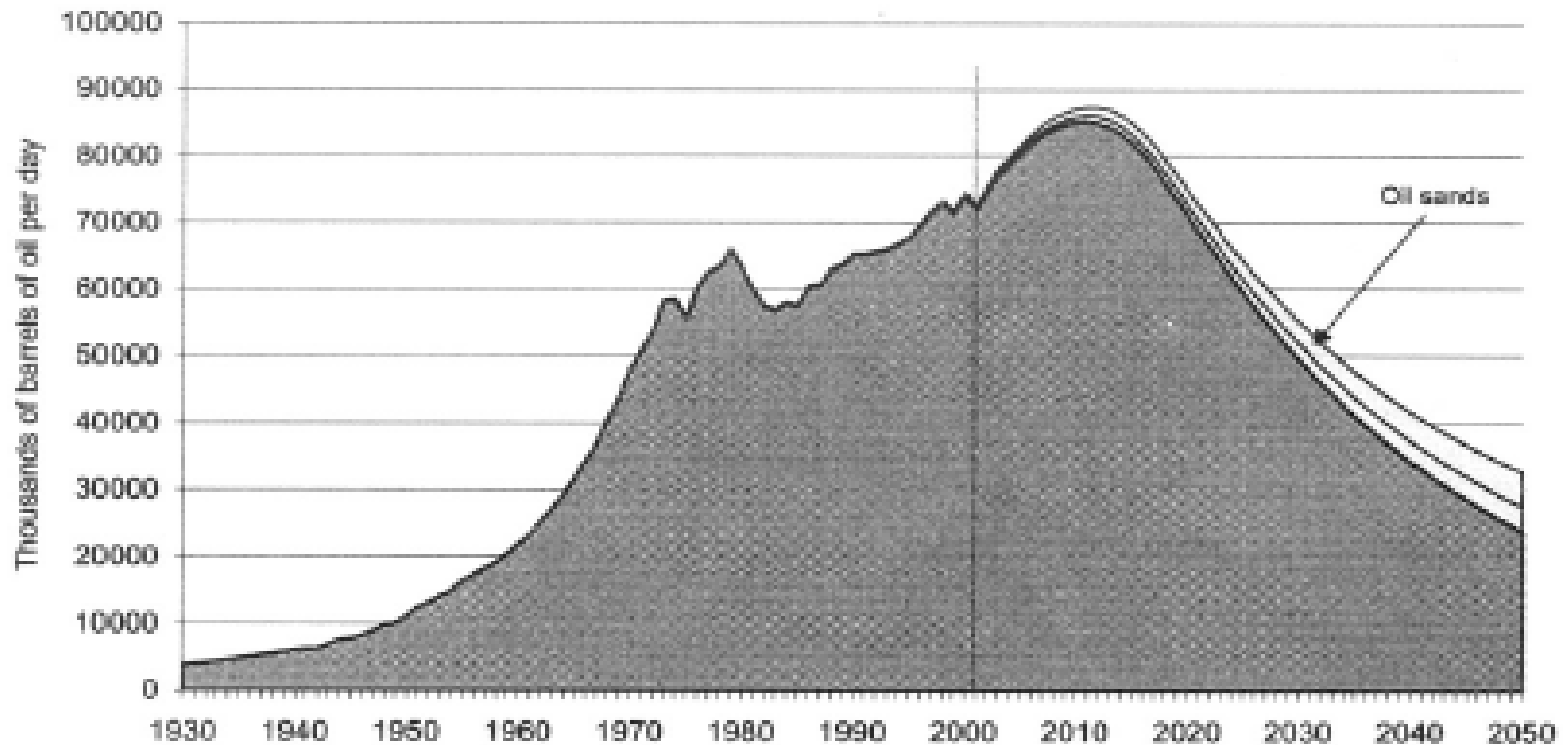
China and India: Where the US was during WWI



Source: S. Davis et al., *Transportation Energy Data Book*, 2003

World Oil: Extraction Rate Near Peak

Recent Oil Production Forecast



Source: Douglas Westwood

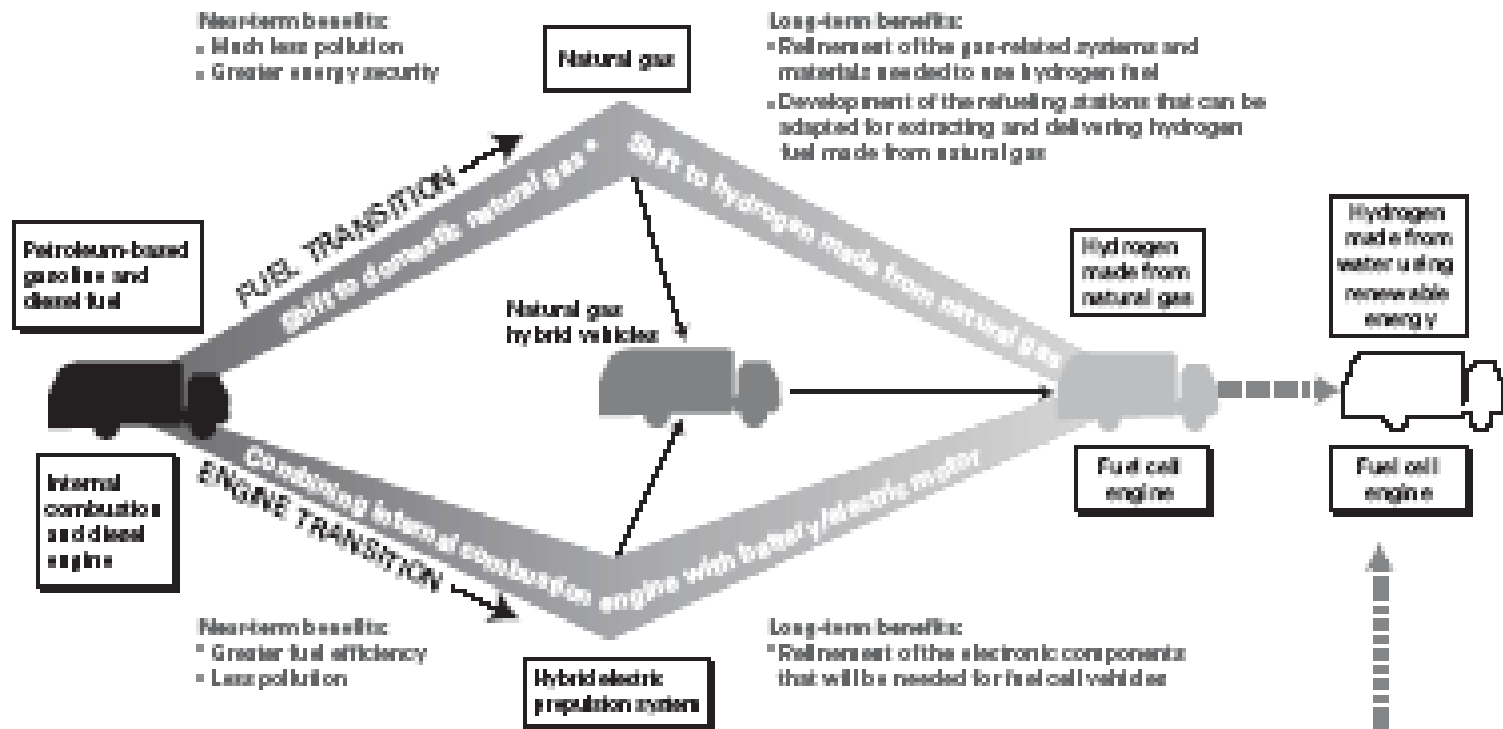
It's Time to Move Beyond Oil!

China and India cannot rely on oil to build a 21st century transport system because:

- ✓ Supplies are insecure – costs are uncertain
- ✓ Competition intense
- ✓ Global oil production is nearing historical peaks
- ✓ Little economic development gain from oil imports
- ✓ Public health consequences catastrophic

Goal: Pollution-free Hydrogen Fuel Cell Vehicles

Figure 4 A Viable Transition Path to Pollution-Free Hydrogen Fuel Cell Vehicles



*Especially in urban fleet vehicles

Taking this final step will require a stronger focus today by the Department of Energy on research and demonstration of distributed solar and other renewable energy resources so that, in one to two decades, renewable energy will be available as the power source to generate hydrogen by splitting the water molecule.

China's NGV Program

China Started in 1999, Against All Odds

- ✓ Local use restricted to Sichuan Province
- ✓ Pipeline to Beijing opened in Sept. 1997
- ✓ Bus program started in 1999
- ✓ Roughly 3,000 NG buses on Beijing roads today, program future tied to 2008 Olympics
- ✓ 70,000 NGVs across country today

India's NGV Program

India Started in 2000, Tied to Pollution

- ✓ **Supreme Court mandate**
- ✓ **Infrastructure problems, protests**
- ✓ **Court extends deadline, reaffirms commitment**
- ✓ **Roughly 90,000 NGVs in Delhi alone, 13,000 buses and 50,000 autorickshaws**
- ✓ **Mumbai has 60,000 NGVs, programs elsewhere raise total to 200,000 NGVs nationwide**

Asia: Fastest Growing NGV Market

China and India Rank in the Top 10

	NGVs	Fueling Sites		NGVs	Fueling Sites
Argentina	1,200,000	1,105	U.S.	140,000	1,300
Brazil	600,000	600	China	69,300	270
Pakistan	410,000	423	Venezuela	50,000	140
Italy	400,000	463	Egypt	49,111	79
India	200,000	185	Ukraine	45,000	130

3.3 Million NGVs Worldwide

Source: International Association for Natural Gas Vehicles

Implications of Transportation Boom

USA Alternative Fuels Program

- ✓ Since 1990, USA has implemented NGV and hydrogen programs (146,000 NGVs and nearly 100 hydrogen vehicles on the road)
- ✓ Best technology in the heavy duty truck sector, 7% of buses use natural gas
- ✓ Technology deployment in the USA lagging, export potential abounds
- ✓ India and China offer unique market opportunities

Pursuing Secure Transport

U.S. Objectives for the 21st Century

- ✓ **Avoid a collision course over oil**
- ✓ **“Inform” and involve the public**
- ✓ **Build domestic energy security and improve public health through NGV and hydrogen use**
- ✓ **Promote USA involvement as a national collaborator providing advanced technology**
- ✓ **Deploy new fuels and technologies in India and China, where need is the greatest**

Recommended Policy Objectives

Natural gas and the path to hydrogen

- ✓ **Promote deployment of natural gas, biogas and hydrogen fueled vehicle as well as hybrid technology in the USA**
- ✓ **Export advanced technology to rapidly expanding Asia markets**
- ✓ **Commit to expanding renewable energy resources to generate hydrogen from water**

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